Comprehensive Environmental Measurements from Autonomous Profiling Floats and Supplement for EM-APEX Presentations and Publications

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LONG-TERM GOALS

My long-term scientific goals are to understand and predict environmental variations in coastal and deep ocean regions. The phenomena include mean and fluctuating currents, such as western boundary currents, density overflows, fronts, internal tides and waves, and ocean responses to storms and hurricanes. In the context of the *Quantification, Predication and Exploitation of Uncertainty (QPEU)*, I want to provide observations of the above phenomena as they apply to the acoustic environment and influence naval operations. In addition, this grant was supplemented to support presentations about EM-APEX capabilities and CBLAST results.

OBJECTIVES

The region of the South China Sea slope and shelf present challenges because of the changing influences of typhoons, non-linear internal waves, internal tidal waves, intrusions of the Kuroshio and water mass fronts and eddies. I want to quantify the dominant spatial and temporal scales for these influences on acoustic propagation, Kuroshio instabilities, and bottom scouring and sediment suspension. It is important to present the results in ways that can be implemented by acousticians conducting simultaneous measurements and modeling.

APPROACH

My intention is to participate in an integrated observational program, as outlined in Figs. 1 and 2. I expect to deploy instruments based on the physics of motional induction: EM-APEX floats. The principal uses are for the mobile floats to determine density and velocity profiles in the Mien-Hua Canyon and Cold Dome eddy, including detailed profiles in the bottom boundary layer where sediment resuspension is expected. The floats report data in near real time via Iridium, allowing mission changes (such as profiling rate and depth) and recovery and redeployment to focus the profiling in specific areas, such as the Cold Dome..

WORK COMPLETED

I participated in three ONR workshops and helped to define the integrated observational program. I investigated the known structure of the Kuroshio and how to deploy both the EM-APEX floats and HPIES landers. Before and after the 3rd *QPEU* meeting, I prepared with Ren-Chieh Lien a component of the joint PO and AO proposal for the *QPEU* DRI in Oct 2007. This work has been funded and is proceeding independently of this grant.

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14. ABSTRACT
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In addition, I have given talks about the EM-APEX float and its measurements in CBLAST at many institutions: SIO, WHOI, UVic, UBC, OSU, AGU's General Assembly and Kiel U.

RESULTS

The principal result of this effort was to participate in the formulation of a research plan for conducting the study of ocean structure and variability that influences performance of acoustic systems. Also, the seminars about CBLAST have advertised results from CBLAST and the performance of the EM-APEX.

IMPACT/APPLICATION

Our plan for deploying EM-APEX is intended to place quantitative bounds on the uncertainty of the ocean and bottom environment, and characterize its impact on low frequency transmission loss, ambient noise, and coherence.

RELATED PROJECTS

Process Study of Oceanic Responses to Typhoons using Arrays of EM-APEX Floats and Moorings (N00014-08-1-0560) as a part of *IWPT* DRI: We will study the dynamics of the oceanic response to the tropical cyclones as well as the recovery of ocean in the western Pacific using long-term mooring observations and an array of EM-APEX floats. Pacific typhoons may cause cold pool on the continental shelf of East China Sea. The dynamics of the cold pool is likely related to the Kuroshio and its intrusion as well as the shelf/slope oceanic processes. The cold pool could produce significant acoustic anomaly that is the focus of the present project.

HONORS/AWARDS/PRIZES

Gledden Sr. Visiting Fellowship at U. Western Australia (Sanford)

SecNav/CNO Chair in Oceanographic Sciences from ONR (Sanford)

IEEE/OES Distinguished Technical Achievement Award for 2008 (Sanford)

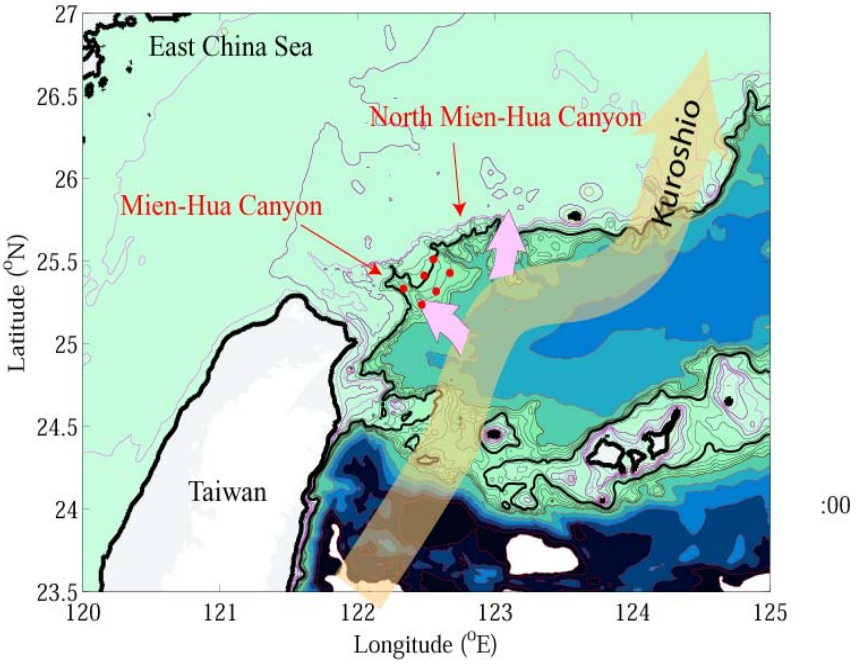

Figure 1: Bathymetry map of the Southern East China Sea. The contour interval is 100 m between 0 and 1000-m depth and is 500m for depth greater than 1000 m. Thick solid curves indicate 0 and 500-m isobaths. The Kuroshio main path and intrusion paths are illustrated. (Six dots mark the location of proposed ADCP moorings.)

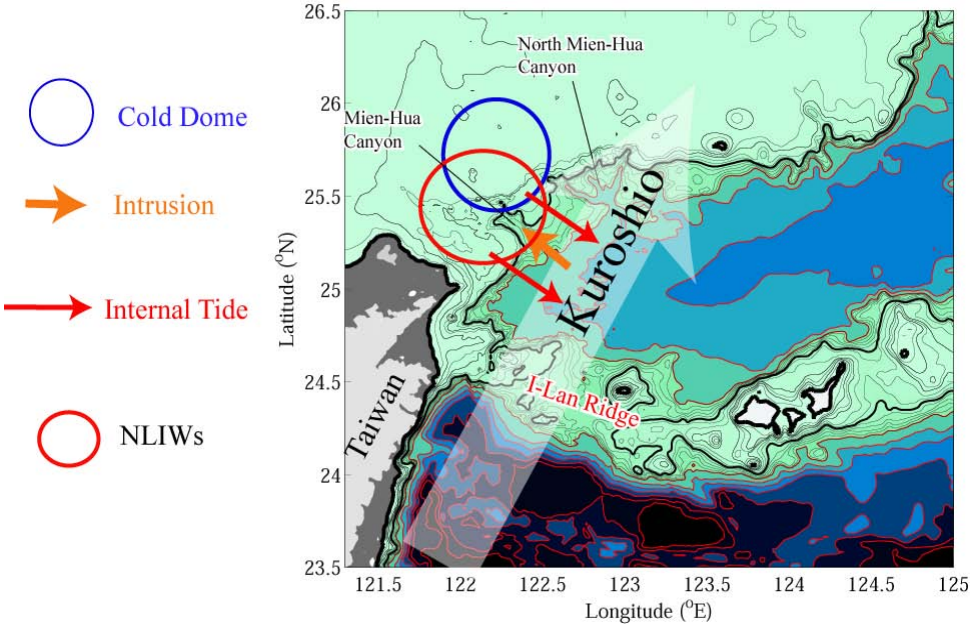

Figure 2: Schematic diagram of oceanic processes in the southern East China Sea (SECS).